EDISON, THOMAS ALVA (*b.* Milan, Ohio, 11 February 1847; *d.* West Orange, New Jersey, 18 October 1931), *technology.*

Edison's parents emigrated from Canada to Milan, Ohio, after his father joined an unsuccessful insurrection in 1837. The elder Edison prospered as a shingle manufacturer until the railroad bypassed the town, and in 1854 the family moved to Port Huron, Michigan, where the father conducted a less profitable grain and lumber business.

Edison's formal schooling was limited to about three months, followed by four years of instruction by his mother. He was an entrepreneur at age twelve, riding the trains to sell newspapers and food and to pick up odd jobs. He had an early and avid interest in chemistry and electricity, performing experiments at home and on the train. He acquired the habit of going for long periods with little sleep—an idiosyncrasy he kept throughout his life. At about age twelve Edison began to grow deaf, to the point where he could hear nothing below a shout. One result of this was to shut him further into himself and to encourage him in a vast self-directed program of reading. A bout with Newton's *Principia* at age fifteen "gave me a distaste for mathematics from which I have never recovered." He was, however, fascinated by various more elementary practical treatises.

In 1863 Edison became a telegraph operator, and this was his main source of income as he moved from city to city, ending up in Boston in 1868. His resolve to become an inventor became dominant, even though some initial attempts proved financially disastrous. He went to New York in 1869 to seek better fortune. In 1870, at age twenty-three, Edison received $40,000 for improving the stock-ticker system and used the money to set up a private fifty-man laboratory. In 1876 this laboratory was moved to Menlo Park, New Jersey, where his most concentrated and productive work was done. Eleven years later he moved to enlarged facilities at West Orange, New Jersey.

Edison was the epitome of the technologist-inventor. He was not unlearned in science—his prodigious reading had carried him through countless semipopular works, and during the year in Boston he obtained the first two volumes of Faraday's *Experimental Researches,* which he later claimed was a source of considerable inspiration to him; certainly the ability of Faraday to get along without mathematics must have been appealing. But his purposes were practical; he invented by design. He would see a gap in the economy, then invent to fill it; and at this he was very good. Examples include his work on stock tickers, multiplex telegraphy, incandescent lighting, magnetic iron-ore separation, and the storage battery. Some items were developed on very short notice to protect a patent position. Edison's chalk-drum telegraph relay and loudspeaking telephone receiver are especially good examples of this. His method in virtually all cases was to try the hundreds or thousands of possibilities that seemed plausible. This was not done in completely haphazard fashion, since he often obtained detailed knowledge of materials before testing them; but his procedure is rightly considered close to the ultimate in "cut-and-try."

The "Edison effect" (emission of electrons from a hot cathode) is often cited as his sole scientific discovery. In 1883 Edison performed a series of experiments to investigate the dark shadow that formed on the inside of a light bulb. He placed a second electrode inside the bulb and found that negatively charged carbon particles were emitted from the filament. He patented the device as a possible meter and then abandoned it. John A. Fleming, a British consultant to Edison, performed some further experiments, and the matter was still in his mind twenty years later when, as a consultant to Marconi, he saw the possibility of using the rectifying properties of a two-element bulb as a radiowave detector.

One product of his practical motivation was that Edison approached certain problems with a point of view different from that of a scientist. Thus some of the latter, contemplating the possibilities of incandescent lighting in the late 1870's, used available information—including indications that the successful lamp (as yet not invented) would have a low resistance—to prove that a system of independently controlled lights was infeasible. Edison changed the parameters by developing a high-resistance lamp and constructed a system that worked. Similarly the experts extolled the value of generators in which the internal and external resistances were equal, hence producing an efficiency of 50 percent. This was the condition for maximum energy transfer. Edison recognized that he did not need maximum energy, and that therefore he could use machines of low internal resistance to obtain much higher efficiencies. Edison may not have been unique in either of these realizations, but he was certainly the first and most successful in putting them together into a practical lighting system.

Edison's laboratories are considered prototypes of the modern industrial research laboratories in terms of the support they gave to manufacturing operations and the training they gave to staff members. The centralization of effort around the ideas of one man, however, was much greater than in later organizations.

In 1915 a consulting board, with Edison as its president, was established to advise the U.S. Navy on the possibilities of using new scientific and technical devices in war. Tangible results were limited, but one of Edison's early suggestions—a permanent scientific laboratory within the Navy—eventually found fruit in the establishment of the Naval Research Laboratory.

Edison was elected to membership in the National Academy of Sciences in 1927.

BIBLIOGRAPHY

I. Original Works. A large body of notebooks, photographs, and other MS materials is preserved at the Edison Laboratory National Monument at West Orange, New Jersey. Other miscellaneous sources can be identified in the Josephson work cited below. Some original apparatus has been saved: in the Menlo Park laboratory building, which has been restored and moved to Greenfield Village in Dearborn, Michigan; in the West Orange laboratory, which has been preserved at its original site; and at the Smithsonian Institution in Washington.

II. Secondary Literature. The best of the Edison biographies is M. Josephson, *Edison* (New York, 1959), although technical details are generally lacking. The Menlo Park years are treated in some depth in F. Jehl, *Menlo Park Reminiscences* (Dearborn, Mich., 1938).

See also H. C. Passer, "Electrical Science and the Early Development of the Electrical Manufacturing Industry in the United States," in *Annals of Science*, **7** (1951), 382–392.

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